

**THIS PAGE IS INSERTED BY OIPE SCANNING
AND IS NOT PART OF THE OFFICIAL RECORD**

Best Available Images

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

BLACK BORDERS

TEXT CUT OFF AT TOP, BOTTOM OR SIDES

FADED TEXT

BLURRY OR ILLEGIBLE TEXT

SKEWED/SLANTED IMAGES

COLORED PHOTOS HAVE BEEN RENDERED INTO BLACK AND WHITE

VERY DARK BLACK AND WHITE PHOTOS

UNDECIPHERABLE GRAY SCALE DOCUMENTS

**IMAGES ARE THE BEST AVAILABLE
COPY. AS RESCANNING *WILL NOT*
CORRECT IMAGES, PLEASE DO NOT
REPORT THE IMAGES TO THE
PROBLEM IMAGE BOX.**



(12) UK Patent (19) GB (11) 2 261 324 (13) B

(54) Title of Invention
RF shielding

(51) INT CL⁷: H05K 9/00

(21) Application No
9223260.2

(22) Date of filing
06.11.1992

(30) Priority Data

(31) **915242**

(32) **06.11.1991**

(33) **FI**

→ (43) Application published
12.05.1993

(45) Patent published
29.11.1995

(52) Domestic classification
(Edition N)
H1R RBH

(56) Documents cited
GB2237147 A ✓
GB2208436 A ✓
GB2200253 A ✓
GB2187893 A ✓
GB1282697 A ✓
EP0275171 A2 2

(58) Field of search

As for published application
2261324 A viz:
UK CL(Edition K) H1R RBH
INT CL⁷ H05K
Online databases: WPI
updated as appropriate

(72) Inventor(s)
Mikko Veijo Tapani Halttunen
Markku Gunnar Kankaanpää

(73) Proprietor(s)
Nokia Mobile Phones Limited

(Incorporated in Finland)

P.O. Box 86
SF-24101 Salo
Finland

(74) Agent and/or
Address for Service
Helen L Haws
Nokia Mobile Phones
Patent Department
St Georges Court
St Georges Road
9 High Street
Camberley
Surrey
GU15 3QZ
United Kingdom

sim 3, 6

1/2
Fig. 1.

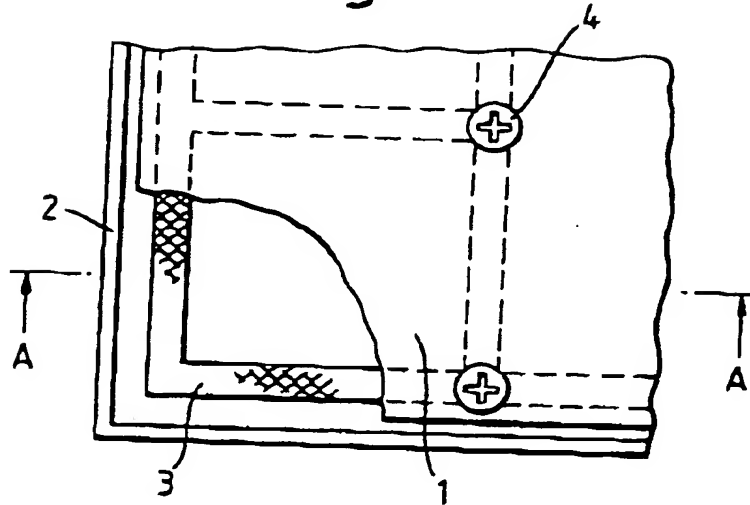


Fig. 2.

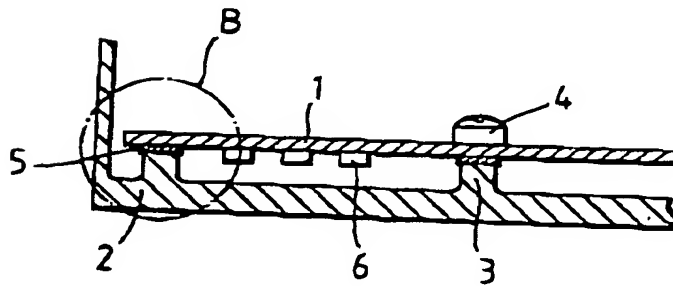
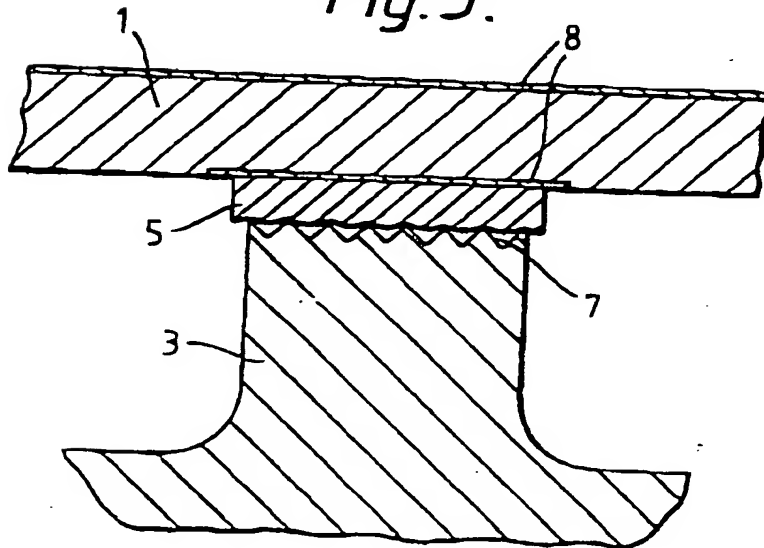


Fig. 3.



2/2

Fig. 4.

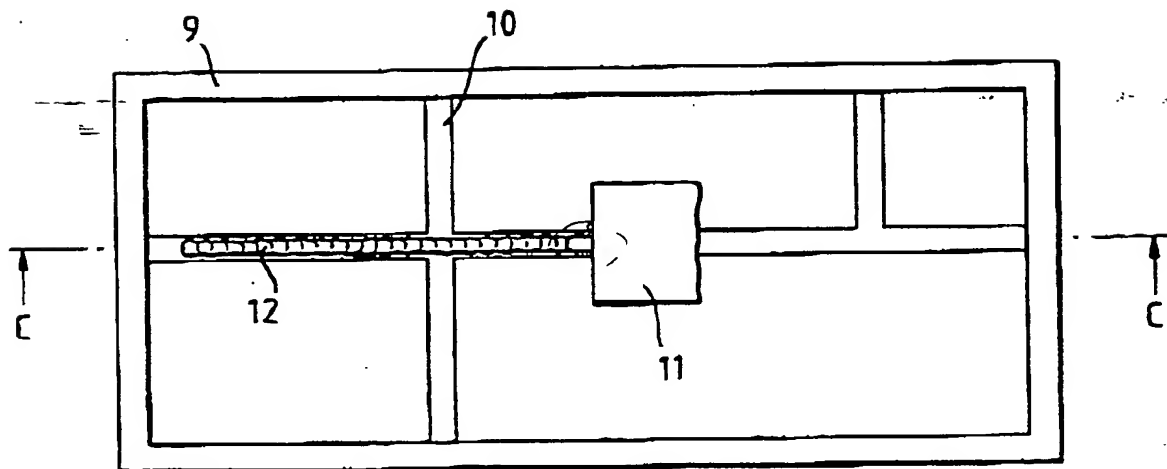
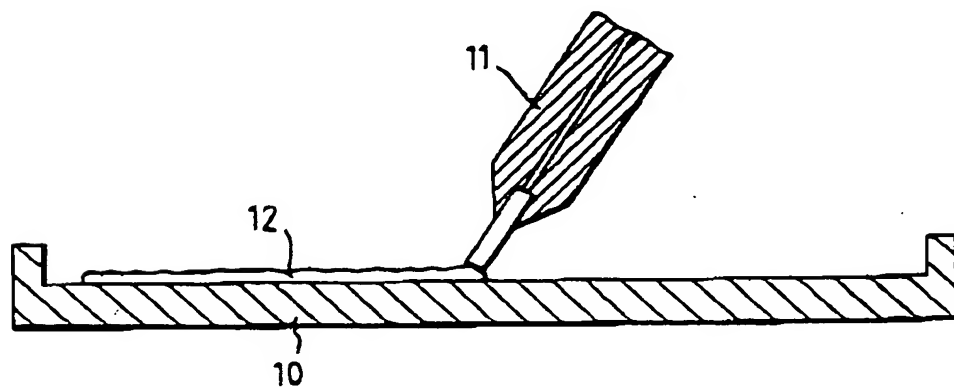


Fig. 5.



RF shielding

The present invention relates to an RF shielding cover and a method of providing a cover on a base member by the application of an electrically conductive material which shields against RF (radio frequency) radiation.

A printed circuit board with electronic components operating within the RF range is usually mounted in a metal housing, in order to shield the components against external interference such as RF radiation and also in order to prevent any radiation from passing from the housing to the surroundings. The housing may be divided into a plurality of compartments by means of partition walls. The housing and the compartments are usually closed using a metal cover. In order to achieve adequate RF shielding, an RF-shielding strip of an electrically conductive material is fitted between the housing and the cover. One such arrangement is shown in US patent publication 4,945,633.

In known arrangements, a pre-shaped RF-shielding strip (gasket) is installed in place manually. This is a slow working step with a high personnel capacity requirement. In addition, the completed strip will have been given a high degree of finish by the manufacturer, a fact which is reflected in the price of the product.

RF leakage into or out of an RF shielded area of a printed circuit board will occur predominantly through RF leakage paths at the interfaces between structural parts of an electronic device, such as for example between; the circuit board and the shielding housing; the wall of the shielding housing and the cover of the shielding housing; the circuit board and the shielding

housing; and the circuit board and the wall of the shielding housing.

According to the present invention there is provided a method for providing a cover on a printed circuit board to shield against radio frequency (RF) radiation, the cover having a wall with an edge for contact with the printed circuit board, the edge being formed with a plurality of recesses, wherein an electrically conductive RF-shielding material is provided between the cover and the printed circuit board, the electrically conductive RF shielding material being provided in a substantially fluid form such that the shielding material sinks into the recesses provided in the cover whereby providing an RF seal and contact between the cover and the printed circuit board.

An advantage of the invention is the substantial elimination of the disadvantages inherent in the prior art and the provision of a method by which RF shielding can be implemented efficiently, simply and economically.

The shielding material used is preferably applied by using a printing technique, an extrusion technique or is applied to an edge of the cover by placing said edge in an adhesive shielding material.

Suitable shielding materials include various electrically conductive plastics, adhesives and elastomers, metallized plastics and carbon paste, as well as other polymer pastes. One suitable material is carbon-silver paste. Depending on the material, it may be necessary to harden the mix by means, for example, of UV light.

3

When an extrusion technique is used, the mix must be a fluid of a suitable viscosity to enable it to be applied by means of an extruding apparatus. Such a fluid would include a paste. Through out this specification the term "fluid" is intended to include a

paste.

When a printing technique is used, the requirements set on the material are dependent on, for example, the printed circuit board application, the welding process, and the construction of the device.

If an adhesive paste is used the cover may be placed in the adhesive paste so that the past adheres to the peripheral edge of the wall of the cover before the cover is placed on the base member.

The material maybe applied directly onto the printed circuit board by a printing technique in connection with the process of manufacturing the printed circuit board.

The housing may be a metal housing or a housing made of metallized plastic. The housing may have a plurality of compartments separated from each other by walls. In this connection, the word 'housing' refers in the main to a case-like structure, but when a plurality of printed circuit boards is involved, the word 'housing' also refers to a housing, located between the printed circuit boards to improve the stiffness of the structure.

Grooves or other recesses

allow

the RF-shielding material to
sink into them , thereby improving the seal and
the contact.

Embodiments of the invention is described below in greater detail, by way of example, with reference to the accompanying drawings, in which:

5

Figure 1 depicts a schematic partial top view of a printed circuit board mounted in a housing with an RF-shield in accordance with the invention;

Figure 2 depicts a section through A-A in Figure 1;

Figure 3 depicts area B of Figure 2, on an enlarged scale;

Figure 4 depicts a schematic top view of the application of an RF shielding mix to a housing, in accordance with the invention; and

Figure 5 depicts a section through C-C in Figure 4.

Figures 1 to 3 depict a printed circuit board 1 mounted, in accordance with the invention, in a metal or metallized housing 2 with an RF-shield, there being components 6 on one side of the printed circuit board. The housing has a plurality of compartments, which are separated from each other by walls 3.

Between the printed circuit board 1 and the housing walls 3 there is a sealing, electrically conductive, RF-shielding mix 5, which has been applied, for example, by a printing technique either in those areas of the printed circuit board 1 which come against the walls 3 or on the upper surfaces of the walls 3 which come against the printed circuit board.

In the upper surfaces of the housing walls 3 there are grooves 7 or other recesses, in which case the shielding mix 5 will sink into the recesses, thereby improving the seal and the contact (Figure 3). The upper surface of the printed circuit board 1 and those

areas of its lower surface which are in contact with the RF-shielding mix 5 are coated with copper 8 (Figure 3).

The printed circuit board 1 is secured to the housing 2, for example, by means of screws 4, whereby there is formed between the printed circuit board and the housing, in the area of the shielding mix 5 and the housing wall 3, an electrical contact or a contact which prevents the passing of radiation from one compartment to another, or out of a compartment.

In the embodiment depicted in Figures 4 and 5, the electrically conductive mix 12 is extruded by means of an "In line" or "On line" automatic dispensing apparatus 11 onto the upper surfaces of the walls 10 of a housing 9 having a plurality of compartments, in order to provide a sealing RF-shielding mix. The printed circuit board is then secured to this housing, for example in a manner corresponding to that depicted in Figures 1 to 3, whereby tight RF shielding is produced between the printed circuit board and the housing. By this technique the electrically conductive mix can also be extruded onto the cover in order to provide a sealing RF-shielding mix between the cover and the housing. The dispensing (quantity, capacity) of the mix can be regulated by means of nozzle size, extrusion pressure, or by a predetermined program.

The term "paste" is particularly intended to include carbon paste or adhesive conductive paste.

In view of the foregoing it will be clear to a person skilled in the art that modifications may be incorporated without departing from the scope of the present invention.

Claims

1. A method for providing a cover on a printed circuit board to shield against radio frequency (RF) radiation, the cover having a wall with an edge for contact with the printed circuit board, the edge being formed with a plurality of recesses, wherein an electrically conductive RF shielding material is provided between the cover and the printed circuit board, the electrically conductive RF shielding material being provided in a substantially fluid form such that the shielding material sinks into the recesses provided in the cover whereby providing an RF seal and contact between the cover and the printed circuit board.
2. A method as claimed in claim 1, wherein the shielding material comprises an electrically conductive plastic.
3. A method as claimed in claim 1, wherein the shielding material comprises a conductive paste.
4. A method as claimed in claim 3, wherein the shielding material is adhesive.
5. A method as claimed in any preceding claim, wherein the shielding material is applied to an edge of the cover.
6. A method as claimed in any previous claim, wherein the application of the electrically conductive shielding material is performed by a printing process or an extrusion process.
7. A method as claimed in claim 5, wherein the

shielding material is applied to the peripheral edge of the cover by placing said edge into the material and allowing the material to adhere to said edge.

8. A method of providing a cover as hereinbefore described with reference to Figures 4 and 5 of the accompanying drawings.

9. An RF shielding cover as hereinbefore described with reference to Figures 1 to 3 of the accompanying drawings.